

UNDERSTANDING SELECTION PROCESSES:
ORGANIZATION DETERMINANTS AND PERFORMANCE OUTCOMES

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Office of Educational Research and Improvement, U.S. Department of Education.

The findings and opinions expressed here do not reflect the positions, policies of OERI, the U.S. Department of Education, or the Bureau of the Census. The authors are listed alphabetically. Please do not cite without authors' permission.

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Abstract

We use an establishment-level survey to examine the predictors of different types of selection practices as well as the relationship of different selection practices to organizational performance. We find that a wide range of contingencies in the organization, including job requirements, organizational size, union status, salary, and training, predict the intensity and the types of selection practices used. Further, we find that selection intensity has a significant and negative relationship with organizational sales, other things equal, that is driven by the use of less valid selection techniques.

Employer decisions about the selection of employees are central to the operation of organizations and to a series of outcomes that matter to individuals, organizations, and society. Perhaps the most basic question in this area is why employers engage in selection efforts at all. Why are some intensive users of selection information and procedures while others are not? And for employers that engage in selection, why are different criteria emphasized? In the analysis that follows, we use a unique data set on establishment practices to examine the factors that affect employers' decisions about selection practices and the relationship between their selection practices and organizational performance.

The Selection Process

A reasonable conception of the hiring process, which creates the context in which selection takes place, might begin with recruitment. Recruitment includes attracting applicants, gathering information about them, and shaping the perceptions of those applicants. There is a fairly extensive body of research focused on explaining the success of individual recruits based on factors such as the choice of recruiting techniques (see Rynes, 1991, for a survey). Employees choose where to apply based in part on the recruitment process and the information gathered about the job and the organization (Wanous, 1976). This part of the process, which corresponds to employee search, also has a large body of research associated with it, mainly in economics (see Schwab, Rynes & Aldag, 1987, for a review of research across disciplines). The employer then uses selection criteria to gather information about applicants, to differentiate among them, and then to extend job offers. Finally, the employees complete the search process by choosing among job

offers.

Diverse disciplines have focused on one or another aspect of the selection process. Labor economics, for example, has concentrated on the employee's job search and tends to view the matching process as driven by employee choices (e.g., B.P. McCall, 1990; J.J. McCall, 1970). Less time has been spent considering the employer's decisions (an exception is Baron, Bishop & Dunkelberg, 1985). Personnel psychology concentrates on both the employee's and the employer's decisions regarding such things as the recruitment process (e.g., Rynes, 1991; Wanous, 1976, 1977) but has tended to focus mainly on employer's goals when evaluating the effectiveness of selection methods, on how valid different selection practices are at selecting "good" workers (see Guion, 1991, for a review).

As Schneider and Schmitt (1986) report, there has been a distinct lack of research on selection practices at the organizational level, and in particular on the relationship of such practices to performance. A few studies, like Jackson, Schuler and Rivero (1989), have examined factors at the organizational level -- mainly industry type and organization size -- that affect the choice of some human resource practices, but there have been no studies specifically aimed at the determinants of selection practices. While research on selection and individual performance is vast (e.g., Hunter & Hunter, 1984), Terpstra and Rozell (1993) present what appears to be the only systematic effort to examine the effect of employer selection decisions on organizational performance. They found a positive relationship between the use of more selection practices and organizational performance and call for research to examine other factors in addition to their use of industry and organizational size as the explanations of selection (and the selection-

performance link).

Understanding the contingencies surrounding the choice of employment practices has recently become an important research topic. Theoretical research by Milgrom and Roberts (1992) offered a series of arguments about the ways in which various practices might be complements for each other, reinforcing their effects, as well as arguments about how others can be substitutes. Empirical research by Arthur (1994) finds that employment practices in steel mini-mills seem to be grouped in distinct sets and that those sets of practices are associated with particular approaches to steel making. MacDuffie (1996) finds that practices like team work and training are "bundled" together and are associated with certain manufacturing strategies. Ichniowski, Shaw and Prennushi (1996) find not only that practices bundle together but that practices within these bundles have synergistic effects on performance. We explore similar arguments with respect to employee selection in an effort to understand why employers pursue different selection practices -- indeed, why some apparently spend little effort on selection at all -- issues that have until now been virtually unexplored.

Understanding Employers' Selection Processes: A Contingency Approach

What causes some employers to invest more in selection, attaching value to it, while others do not? For those employers that rely on selection, why do some vary in the way in which they select employees? One way to begin thinking about these issues is with an "ideal type" thought experiment: What would it mean for an employer to not rely on selection? What conditions would make it reasonable to not invest in or rely on active policies of employee selection?

An employer who does not engage in selection is one which simply takes

applicants at random to fill positions. There may be circumstances that make this a reasonable approach. The clearest example might be in situations where hiring mistakes cost the employer relatively little. Where workers are paid piece rates, for example, the employer may be protected from hiring "bad" or low productivity workers because the wages vary directly with the employee's performance. For example, growers who pay workers piece rates for picking crops suffer essentially no penalty from having a low-productivity worker in the fields as that worker's wages will be proportionately low; neither do they gain a premium from having superior workers as the wages for those workers are proportionately high. Such employers typically do not bother to screen applicants with care.

Other circumstances where the incentives to invest in selection are reduced include situations where selection is expensive relative to the benefits. One such situation might be where employee turnover is very high. If, for example, the average tenure in a job is short, the benefits of better employee performance associated with superior selection accrue for such a brief time as not to merit the costs of extensive selection. Historically, casual and short-term work is often associated with hiring halls where screening and selection are minimal, in part because the costs of selection are not worth the benefits. Perhaps the majority of unskilled, industrial employees in the United States before the 1920's were hired with no systematic efforts at selection. Jacoby (1985) reports how Philadelphia employers in this period would throw oranges into a crowd of job seekers: the ones who caught the oranges were hired.

Similarly, if the requirements of the job are either very low or regulated by machine or standards, it may reduce the incentive to screen

applicants. First, jobs may be so low in complexity that virtually all applicants could perform adequately, thus making random selection an attractive option. Although person-job fit research would argue that over-qualification for the job may create problems such as turnover (e.g., Wilk, Desmarais & Sackett, 1995), differences among most of the applicants for such jobs may translate into little difference in overall performance. Job design of factory work associated with scientific management, for example, created jobs that were so simple that unskilled, illiterate workers were capable of performing adequately. In addition to the skill issue, the opportunities for low quality workers to "shirk" in their duties are also sharply reduced in the machine-paced job design of scientific management. Jones (1984) argued that tasks that are more easily monitored and where worker output is more easily measured, like with a piece rate system, are more "visible" and thus reduce the incidence of free-riding and shirking.

Finally, there may be rare occasions where selection is not worth the cost, even for high-skilled jobs, if the job requirements and applicant credentials are so clear that self-selection meets the general need to screen employees. For example, most licensed electricians will perform a given piece of work the same way and to the same quality standard. The training associated with licensing and the requirements of building codes remove much of their discretion, so it may not be worth much of an investment to try to select a "better" electrician from the pool of potential applicants.

Conversely, we might expect that investments in selection will pay bigger dividends where the benefits of finding better workers are greater (where the work is higher-skill, less clearly defined, and more autonomous; where turnover is lower) and where the costs of selection are lower.

Hypotheses

Using the contingency approach, we offer a set of hypotheses examining the selection intensity of employers. Selection intensity refers to the amount of selection used to screen applicants. A section to follow discusses different types of selection and the hypotheses regarding the selection-performance link.

Selection Benefits Exceed Costs. There are two ways to improve the returns to investment in selection: One is to get more benefit from the workforce that is selected, and the other is to reduce the costs of selection.

Where skill requirements are higher and perhaps not easily captured by clear credentials, as with teamwork or interpersonal skills, employers may rely more on a variety of selection practices because the odds that a workforce that was selected randomly from applicants or from standardized credentials would have these skills is lower. This might include cases where a company's competitive strategy is based more on skill, as with innovation strategies (Jackson & Schuler, 1987) rather than, for example, on being the low price leader.

H1: Selection intensity should be greater, other things equal, where skill requirements are higher.

The benefits from selection are greatest if employees stay with the organization longer, *ceteris paribus*. Where turnover is lower, employees remain with the organization longer, making the costs (benefits) of poor (good) workers larger and, in turn, the benefits of selection greater.¹

H2: Selection efforts should be more intense, other things equal, where

¹ Note, however, that effective selection may also make for better matches between jobs and employees, reducing turnover (e.g., Wilk, Desmarais & Sackett, 1995; O'Reilly, 1977).

employee turnover is lower.

Institutional arrangements like unions and collective bargaining agreements may also make selection more valuable. Union coverage is associated with reduced turnover, especially employer-initiated severance, and increased training (e.g., Freeman & Medoff, 1984). Collective bargaining and grievance procedures also give employees mechanisms for resisting management initiatives, increasing the incentives for the organization to select workers who "fit" and are not in conflict with the organization. Although union contracts in the U.S. do not cover applicants, the practices associated with union contracts may indirectly affect the selection and hiring practices of employers by creating incentives for more careful selection.

H3: Selection efforts should be more intense where union coverage is greater.

The second way to improve the cost/benefit ratio of selection efforts is to reduce the costs. Where the costs of using selection programs are lower, employers should be expected to make more extensive use of them. Because there are fixed costs associated with using various selection procedures, larger organizations, which may have more opportunity to hire on average, may find it cheaper to use them. Another argument is that larger organizations have high monitoring costs and thus must be more intensive in their selection.

Baron, Bishop & Dunkelberg (1985), for example, found that large employers search more.

H4: Selection intensity should be greater in larger organizations.

Where companies subsequently make substantial investments in employees, more extensive selection may pay in order to ensure that the employees have the attributes that will make such investments worthwhile. An illustration of this phenomenon is that employers invest more training in those workers that have more education presumably because more educated workers are better prepared to absorb and use training investments. Baron, Bishop & Dunkelberg (1985) found that employer search, measured both in number of applicants interviewed and the time spent per interview, was positively related to the level of training provided to new hires. Similarly, we expect employers who provide more training to invest more in the selection of their employees.

H5: Selection efforts should be greater, other things equal, where the human capital investments (training) are greater.

Other things equal, more extensive selection pays off where the costs of making hiring mistakes are higher. When labor is expensive (wages are high) the cost of an unproductive employee is greater, thus making selection efforts more important.

H6: Selection efforts should be greater where wages are high.

Selection as a Substitute. Another set of arguments suggest how employer selection efforts may be a substitute for other approaches to securing an adequate workforce. For example, an alternative to selecting a workforce that is already skilled is to train one that is not, the "make or buy" decision (e.g., Miles & Snow, 1984). For a workforce of a given quality, employers who train more might under this argument be expected to invest less

in selection.

H5A: Selection efforts should be lower, other things equal, where the human capital investments (training) are greater.

A similar substitute argument can apply for wages. Higher wages should, other things equal, attract a larger and more qualified applicant pool. Because it is a boon for recruiting, wage premiums might make it possible for an employer to spend less on selection.² Holzer (1990) found, for example, that high-wage firms perceived greater ease in hiring (but generally spent more time doing it because they were handling more applicants).

H6A: The intensity of selection should be reduced, other things equal, where employers offer higher wages.

The characteristics of the local labor force are thought to play an important role in where employers decide to locate establishments (e.g., Barkley, 1988; Galbraith, 1985). The "greenfield" plant strategy, for example, is one where employers locate facilities in relatively homogeneous rural communities with strong work ethics and opposition to unions. Because the applicant pool for production jobs in particular tends to be within commuting distance, the location decision serves in part as a means of screening applicants for production jobs. Barron and Gilley (1981), for example, make the case that search costs are reduced when many firms with similar employees are together in the same region. An organization seeking to locate there may more readily locate employees with the necessary skills, thus lowering search costs. The importance of the labor market as a prime factor

² On the other hand, having a larger applicant pool -- even if it is on average more qualified -- may not reduce the need for selection if the dispersion of quality has increased along with the applicants. Depending on the employer's risk preference for selecting problem employees, a higher

in location decisions is a relatively recent phenomenon as more traditional criteria for placing facilities, such as access to markets, have eroded in importance. We might therefore expect establishments that have been in their current locations only recently to have a better match with the local labor market and to have somewhat less need for selection as a result.

Establishments that have been in place for long periods may also find that their communities change over time, making for a poorer match between their hiring needs and the characteristics of the local labor market.

H7: Establishments that have located more recently should make less intensive use of selection than those that have been in place longer.

These arguments about how other practices might serve as a substitute for selection all assume that the desired quality of the workforce is more or less given and that trade offs with other factors appear at the margin. In practice, being able to measure and control for the desired quality of a workforce may be a difficult task empirically, suggesting limits on the ability to estimate these arguments.

Selection Type. In addition to intensity, selection efforts also can vary in their content. Employers differ both on the methods they choose and the employee attributes that they value. The research in personnel psychology that evaluates the methods of selection is exhaustive. In general, the conclusions suggest that among the least valid methods are unstructured interviews of employees (e.g., Arvey & Campion, 1982). Recommendations in general are not reliable indicators of performance, especially in recent years in the U.S. where an explosion of litigation has made it risky to offer

average quality workforce with lower dispersion may not reduce the selection challenge substantially.

references that may contain information critical of an applicant. Among the most reliable and valid sources of information, in contrast, are formal selection tests, especially those that measure general ability or job-related skills (Hunter, 1986), structured interviews (e.g., McDaniel, Whetzel, Schmidt & Maurer, 1994) and biodata which measures the prior education or experience of applicants along the lines that an accurate resume might (Cascio, 1982). One reason biodata tends to a good method of selection is that behavior tends to be consistent; that is, past behavior predicts future behavior.

There is obviously a strong overlap between the methods used to select applicants and the nature of the information they collect, but the overlap is not always perfect. Ability tests, for example, are designed to capture various aspects of ability (e.g., generally cognitive ability). Interviews may also be an attempt to get at an applicant's abilities, but they are perhaps better suited to measuring less tangible factors such as interpersonal skills, values or attitudes (Guion, 1991).

Selection and Organizational Performance. We examine the relationship between selection measures, both intensity and the types of selection, and two measures of organizational performance: the employer's estimate of the proficiency of their workforce (an estimate of workforce performance) and the establishment's total sales which captures overall organizational performance (the presence of control variables that measure establishment size makes this a per employee sales measure).

Potential relationships between selection and performance measures could well be ambiguous. We might imagine that more selection information is better, other things equal, but it is also important to know what the costs are of collecting that information. In these analyses, therefore, we also

include a measure of the amount of money that the establishment spent on recruitment and selection. The coefficients for the selection measures therefore explain what the return is to relying on certain selection information holding the costs of collecting that information constant.

Utility analysis is an approach to determine the usefulness of selection practices for the organization by costing out the process and providing, in dollar terms, a gain/loss evaluation (Boudreau, 1991). Although we recognize the importance and the complexity of utility analysis to this question, we do not purport to be taking such an approach. Nor are we attempting to estimate the potential gains from additional selection as Hunter and Schmidt (1982) do. Instead, this study asks a simpler question: do selection efforts matter to organizational performance?

Here, we offer two hypotheses. The first concerns the overall intensity of selection. Research has shown that improving the fit of workers to their jobs can lead to substantial productivity improvements (Hunter & Schmidt, 1982). Fit can be improved by gathering information about applicants to be used to sort workers into jobs. Following Schuler and Jackson's (1987) argument that more information on employees is better, it would seem reasonable to suggest that the establishments should benefit from more intensive selection efforts, especially when controlling for the costs of selection.

H8: Selection intensity will be positively related to organizational performance.

Focusing on type of selection, we might expect the impact of less valid selection tools (e.g., recommendations) to have a negative effect on both performance measures. Utility analysis research has found that the more valid

a selection practice, the more positively linked to outcomes (see Boudreau, 1991, for a review). Likewise, we expect the relationship between selection processes that focus on more valid and work-related criteria (e.g., ability and education) to be positively related to the organizational outcomes.

H9: Selection using more valid processes will be more strongly related to organizational performance than selection using less valid processes.

We use a unique set of data on establishment selection practices to examine the hypotheses outlined above.

Method

Data

The EQW National Employer Survey: A recent establishment-level survey of employment practices conducted by the Bureau of the Census for the National Center on the Educational Quality of the Workforce (EQW) is used to address the above hypotheses. The survey was administered by the Census as a telephone survey in August and September of 1994 to a nationally representative sample of private establishments with more than 20 employees. In contrast to data on companies, where practices may vary across location or divisions, data on establishments, which represent single locations, are more likely to capture actual practices. Information on employer practices in general is difficult to obtain from other sources, and the National Employer Survey (NES) is unique in that it provides detailed information on wide-ranging practices such as recruiting and selection, work organization, and training and education practices.

Because the survey was designed to identify employer practices at for-profit establishments, it excluded public sector, not-for-profit, and corporate headquarters respondents from the sample. The survey examined

establishments with more than 20 employees as such establishments employ about 75 percent of all workers in the U.S. The target respondent in the manufacturing sector was the plant manager; in non-manufacturing, the local business site manager. The respondents were likely to have had experience completing establishment surveys, having been contacted by the Census on other occasions. The survey was designed to allow for multiple respondents, especially important for multi-establishment enterprises where, for example, financial information was typically maintained at corporate headquarters. Computer Assisted Telephone Interviewing (CATI) was used to administer each survey, and the approximate time to complete a survey was 28 minutes.

The sampling frame for the survey was the Census Standard Statistical Establishment List (SSEL) file, arguably the most comprehensive and up-to-date list of U.S. establishments. Four-thousand, six hundred and thirty-three eligible establishments were contacted by Census, and 1,275 refused to participate in the survey. The 72 percent response rate which results seems to be the highest among contemporary employer surveys.³ The most common reason for not participating was that the respondents did not participate in voluntary surveys or were too busy to participate. Probit analyses conducted by Lynch and Black (1995) of the characteristics of non-respondents finds no particular differentiating characteristics except that manufacturing respondents with more than 1,000 employees were less likely to participate. We believe that these data represent the highest quality information available so far on employer practices and characteristics.

Variables

³ Surveys that were incomplete on the cutoff date of October 1st 1994 were dropped from the study, leaving a sample of 2,945 and a working response

A brief summary of the study variables is found in Table 1. Additional description is provided for turnover, skill requirements and selection practices below.

Turnover. We measure turnover with a variable measuring the percentage of the workforce with less than one-year of tenure. When we control for the size of the establishment and whether employment is growing, this variable should give us a reasonable estimate of employee turnover.

Skill Requirements. Several questions focus on the skill requirements of the organization. One question asks specifically whether skill requirements have risen in the last three years. Although not the same as the level of skill requirements, it does capture whether or not the work is, in general, being up- or down-skilled. Other questions deal with aspects of the workplace that proxy for specific skill requirements; namely, the extent of computer use, the proportion of employees working regularly with others in teams and the presence of a TQM program, which add complexity to the production workers job; and the average education of the production workers, which reflects skill requirements. Computers have been found to increase wages 10 to 15% over jobs that do not use computers (Krueger, 1993) and to free workers from the more routine aspects of their jobs to concentrate on the more complex and exceptional aspects (Levy & Murnane, 1996). Thus, the use of computers is believed to increase skill requirements for production level workers.

As Klimoski and Jones (1995) note, teamwork at the production level requires an expanded set of knowledge, skills and abilities (KSA's). In addition to those necessary for adequate job completion, skills around

rate of 64 percent.

coordination, decision-making and planning with others are also essential. Similarly, Stevens and Campion (1994) divide the KSA's necessary for success in team-based work into interpersonal (e.g., conflict resolution, communication) and self-management (e.g., goal setting, performance management) that imply a more complex skill mix if not a more complex level of skill. Average education level should obviously be linked to focusing on education in selection, but it is also interesting to see how it will relate to overall selection intensity. Finally, we include a question about the establishment's overall strategy, whether it competes mainly on the basis of innovation, rather than say, price. Following Schuler and Jackson (1987) innovation may require more intellectually from workers than some other competitive strategies.

Selection Practices.

We use the NES to examine selection practices at establishments in the U.S. The survey asks respondents to rate on a five-point scale the importance to them when hiring production or front-line workers of a range of selection practices. The question asks: "When you consider hiring a new, non-supervisory or production worker (front-line worker), how important are the following in your decision to hire?"

The 11 selection items described in Table 2 are not all equivalent and reflect some of the overlap between attributes and methods noted above. Some focus on desired applicant characteristics, such as communication skills and attitudes, while others ask about mechanisms for securing information, such as employer recommendations.⁴

⁴ One potential ambiguity in the question is whether respondents believe that the hiring decision is separate from the recruiting decision. In other

Insert Tables 1 and 2 about here

The question asks about the relative importance of selection criteria rather than actual practices, but it seems reasonable to assume that the responses summarize the use of practices and their relevance. For example, it seems reasonable to assume that an employer who responds that selection tests are very important in their hiring decisions uses such tests; an employer who reports that selection tests are unimportant may not perform them or may not pay attention to them. We used the responses to this question to create measures of selection practices of establishments.

Selection Intensity. A general measure of the intensity of an establishment's selection efforts was created by simply summing the scores for each of the hiring items. This measure represents the attention employers

words, does the hiring decision refer to the entire process of securing employees or does it refer to selection among applicants? If it is the latter, the important issue is whether the applicants have already been screened in some important way. Critics suggest, for example, that some jobs may require a high school degree, in which case, all of the applicants may have such degrees. An employer whose applicants all have high school degrees may therefore report that "years of completed education" is not important in their decision, when the way to interpret that response would in fact be that years beyond a high school degree are not important. It is unlikely that this kind of applicant screening would apply to any issue other than education that is captured by our question. Court decisions like *Griggs v. Duke Power* (1974) have made it unlawful for employers to require academic degrees or credentials unless they can demonstrate explicitly that the knowledge, skills, and abilities associated with that degree are required to perform the job being filled because of potential adverse impacts. (If an applicant a few credits short of graduation has the relevant skills or they could be learned in some other context, then the degree requirement fails the test.) Our check of the Philadelphia area want ads over a one week period found no job ads for production work that mentioned any educational requirements. Even if respondents interpreted the question as being independent of recruitment screening, we believe that any resulting bias in the responses should be minimal.

give to the whole range of employee attributes when hiring, with higher scores associated with greater attention to more selection criteria.

Selection Type. We also examined the extent to which establishments pursued distinct sets or combinations of selection practices. Both logical sorting and empirical (factor analysis) sorting were used to create groupings of selection practices. We created three principal factors from the analysis of the 11 items asked in the selection question. See Appendix A for the complete factor loadings.

Five items loaded on the first factor which captured those selection practices that focus on ability and education (**Ability/Education**; e.g., educational performance (grades), years of completed schooling, credentials). Focusing on things like ability and education reflects a human capital approach to selection. BNA (1988) reports that about 20 percent of organizations use ability tests and 11 percent use biographic information, which would include information on education, in a systematic fashion.

Three items loaded on the second factor which captured those selection practices that focus on attitudes and experience (**Attitudes/Experience**; e.g., applicant attitude, communication skills, experience). An organization that relies on attitude and experience may be looking for applicants that are distinctive, for example, that will conform to an employer's values (e.g., Bowles & Gintis, 1976). The socialization literature in psychology discusses the role that the attraction and selection of the right individuals can play in getting newcomers to match with the values of the organization (e.g., Schneider, 1987a, 1987b). Interviews can be used to gather information on these and other characteristics such as friendliness, ability to make a good first impression and the like. Guion (1991) notes that although instruments

may sometimes be used to measure these types of applicant characteristics, an "insightful interviewer" can do a better job. The information regarding past behaviors and experiences is believed to be critical by some to predicting future behavior (Diboye & Gaugler, 1993). Thus, getting the same, relevant, job-specific behavior data from all candidates is crucial whether in an interview or a biodata form.

Three items loaded on the third factor which captured the selection method of using recommendations from various sources to gather information about candidates (**Recommendations**; e.g., recommendations from previous employers, teachers). Recommendations have been of special concern to sociologists, in that they represent the use of networks for finding jobs (Fernandez & Weinberg, 1997; Granovetter, 1974). As noted earlier, recommendations are one of the least valid methods of gathering information about applicants, particularly from previous employers. Legal concerns often restrict what a previous employer can say about an applicant, reducing the validity of the information gathered (Schneider & Schmitt, 1986).

The variance in the selection intensity variable and the presence of these three distinct factors confirms that there are real differences across employers in the importance they attach to selection. The concern raised earlier that the responses to the selection question confounded sources of information on employees with the nature of that information turned mainly on the recommendation items which are both a source and a type of information. The fact that the recommendation items all load onto the same factor may help to clarify the interpretation of the results at least for the separate factors. We turn now to examine the differences in selection practices.

Analyses

Regression analyses were used to test the study hypotheses. Selection intensity and the selection type factors are the dependent variables. In addition to the general hypotheses presented earlier, the different selection practice factors might have substantially different relationships with the various independent variables. For example, we might expect the relationship of the ability/education factor to be particularly strong with training, with rising skill requirements, and with competing through innovation. We might also expect the relationship with selection based on attitude/experience to be particularly strong where teamwork is more important. Because selection based on recommendations appears to be the most ambiguous factor, we might expect it to have the weakest relationship with the model.⁵

In order to examine these differences, multivariate tests (M-tests) were performed on the equations for the different types of selection practices. M-tests are used to test hypotheses when there are a number of dependent variables fit to the same regressors. The M-test can be used to test whether all parameters (except intercept) or particular parameters are equal across equations. Thus, we can examine whether the coefficients for a given variable, for example, computer use, are in fact different from one equation to another. The equations take the following form:

$$Y_1 = B_1x_1 + X\beta + \varepsilon_1$$

$$Y_2 = G_1x_1 + X\Gamma + \varepsilon_2$$

$$Y_3 = L_1x_1 + X\Lambda + \varepsilon_3$$

where the Y's represent different types of selection practices; the

⁵ The recommendations factor is the most intrinsically ambiguous as it refers to a method of selection that does not map neatly onto content:

first term represents the parameter for variable x_1 ; the second term represents, in matrix format, the remainder of the variables in the equation (X) and the parameters on those variables (β , Γ and Λ); finally, the last term is the error term. An M-test for variable x_1 would test the difference between B_1 , G_1 , and L_1 ; an M-test for the whole equation would test both the difference between B_1 , G_1 , and L_1 and the difference between the β and the Γ and the Λ matrices. A significant Wilks' Lambda will indicate that there are differences in the parameters between equations.

For the selection-organizational performance link, analyses are based on production function models where the effects of selection on outcomes is estimated controlling for other factors. Because production functions are thought to be fundamentally different for manufacturing and non-manufacturing establishments, we follow convention and calculate results separately for these two industry groups.

Results

Table 3 contains means, standard deviations and the intercorrelations between key study variables. The results for the overall measure of selection intensity are presented in Table 4. Table 4 contains two different models for the intensity of selection: A baseline model and a variation on that model including a measure of training.

Insert Tables 3 and 4 about here

Benefits of Selection Hypotheses (H1-H4). Selection is greater where more workers use computers and where the average education of production workers is

recommendations could reveal abilities and attitudes as well.

higher. There is some support for increasing skill requirements and for the presence of a TQM program as predictors of selection intensity, although the results were not consistent across both models. There is no relationship with a strategy of innovation as the key for competing or with the measure of participation in meetings.

Selection efforts are less intense where turnover is greater, as expected, across the models. We cannot rule out the possibility, discussed below, that because these establishments do not screen carefully, their turnover is higher because of bad matches. The relationship with union coverage was not significant, which is similar to the finding obtained by Baron, Bishop and Dunkelberg (1985). Perhaps the fact that union operations have, for example, more training and higher wages and that these variables were included in the analysis led to some collinearity with the union variable in our model.

Selection is less intense where establishments are smaller, as predicted, reflecting possible scale effects in hiring, although the coefficients were not significant. These results lend support to Hypotheses 1 and 2.

Selection as Substitute Hypotheses (H5-H7). Establishments where selection is more intense provide more training per employee, as predicted by Hypothesis 5.

The positive coefficient suggests that more intensive training relates to more intensive selection: Training is not a substitute for selection, rejecting Hypothesis 5A. Similarly, the wages for production workers are significant and positive. They are also not substitutes for selection, supporting Hypothesis 6 but rejecting Hypothesis 6A. Year Began Operation was significant and negative, indicating that establishments that have been at

their current location for less time used selection less intensively. This supports Hypothesis 7 and is the only support for a substitute for selection model.

Additional Results. Although no *a priori* hypotheses about race and gender were put forth, we report results for the race and gender composition of the workforce in the two models. The relationship with minorities is negative, although not consistently significant, but the relationship for women is positive and significant, a puzzling result. While both are protected groups, substantially more selection-based litigation has been directed at minorities, and it is possible that employers are keying on that difference and reducing explicit selection efforts to reduce the risk of litigation. But why they should select more intensively where women are employed in greater numbers is curious. (It is important to note that the effect, while significant, is quite small.) It could be that the disproportionate presence of women as employees in an establishment means that the operation is different in some fundamental way, that values characteristics more associated with women.

Additional analyses either controlling for additional variables or examining other possible covariates did not alter our above results. For example, we included controls for both selection costs and for perceived proficiency in Model 1 with no significant change in results. In particular, training and wages are not substitutes for selection even given the same level of inputs (costs) or outcomes (proficiency). We also examined the relationship between selection and monitoring to see whether high rates of supervision and monitoring of employees (measured by the supervisor's span of control) may reduce the need to select carefully among applicants. There was

no evidence of an inverse relationship between monitoring and selection. Finally, we examined the relationship between selection intensity and the amount of training provided by the supervisor for a new production-level worker. We might expect that this type of training would be the most direct consequence of selecting less carefully as poorer quality workers might require more attention from supervisors. The log of the average hours a supervisor spends training a new front-line worker was added to Model 1, the base model, and as with the previous training results, was significant and positive. This provides further evidence that training is not a substitute for selection. The more intense the selection of employees, the more hours a supervisor spent training them. (See Appendix.)

Results by Factor

The Appendix contains the results of the analyses for each of the different types of selection practices. The results for the first factor, ability/education, look very similar to those for overall intensity, with the additional result of a significant negative effect for the small-sized organizations.

The model predicting attitude/experience is less significant. It is not related to wages, presumably because attitudes, a big piece of this factor, are not associated with a credential that carries a clear market price. (In contrast, education is a credential that commands a market wage.) Nor is it related to training or the age of the establishment. It is interesting to note that the percentage of women in the workplace, unlike for ability/education, was not significantly related to selecting on attitude/experience.

And the results for the recommendations factor is the weakest model.

Perhaps the lack of clear relationships here may be related to measurement error associated with ambiguity of the construct, that recommendations may be used to collect a wide range of information. One unique finding in this model is the significance, statistically but not practically, of the percentage of union employees in the models. As this is the only factor that focuses specifically on a method of selection rather than on information garnered from selection techniques, this may explain why this is the only situation in which it is significant across the two models. Why the relationship should be negative is a puzzle given the stereotype that unionized operations hire more based on networks among current employees.

Results of the M-tests

The results of the 'M-tests' indicate whether the coefficients across equations are, in fact, different for each factor. The results are summarized in Table 5. We first examined whether the overall equations differed and then we examined the differences in some of the key study variables. First, the overall analysis indicates that the three factors are distinct in their relationships with the various independent variables. As one looks down the columns, the difference between the ability/education and recommendations equations seem most dramatic with virtually every one of the variables measuring workplace requirements associated with more selection on education/ability criteria than on recommendations. Employee characteristics such as unionization, minority and salary were also differentially predictive across the two equations. A similar pattern exists for these variables between selection on ability/education and attitude/experience. But ability/education and attitude/experience were the most alike in their relationship with the workplace requirement variables. Attitude/experience

and recommendations were the most alike when examining the significant results down the column, with the workplace variables of "skills increased" and "computer use" differentiating between the two. The coefficient on training was not significantly different across the three types of selection.

Insert Table 5 about here

Results for Selection Processes and Organizational Performance

The first set of results examine the relationship between selection and the proficiency of employees as estimated by their employer (Table 6). The concept of proficiency is obviously relative to the needs of the organization and is not an absolute measure of employee quality or performance: an establishment with low quality workers could nevertheless find them perfectly proficient if the technology and work organization were adjusted to accommodate low quality workers. And it might be reasonable to assume that establishments adjust the amount of selection that they do to the desired proficiency of their workforce, leading on balance to no net effect.

Indeed, that appears to be what we initially find with the overall intensity measure of selection. Following the convention with production function models, we examine the equations separately for manufacturing and non-manufacturing establishments and find no effects for either industry grouping. But the results by factor show a significant positive relationship between proficiency and the factor representing education/ability and a negative significant relationship with the factor representing recommendations, by far the largest coefficient in the equation. In other words, establishments that select based on education and ability metrics find that their employees are more proficient, even relative to their own standards, while those that select based on recommendations find that their employees are less proficient. The two results offset each other when the factors are combined in a common intensity variable, explaining the lack of significant relationship in the previous analysis. These results only hold for non-manufacturing establishments, however. Proficiency in non-manufacturing work may be more closely linked to worker attributes identified

by these selection practices than for manufacturing work where tasks are more machine-paced and selection efforts may have less of a payoff.

Insert Tables 6 and 7 about here

The second set of results examine the relationship with establishment sales (Table 7). Overall financial performance measures are reasonably far removed from hiring decisions, and it may therefore be difficult to find relationships between the two. Here the results suggest that, at least for manufacturing firms, more intensive selection of employees is actually associated with lower sales, and the better performing establishments actually select less carefully. This surprising result continues to hold when controlling for the costs of selection: even when it is costless to do so, more intensive selection seems to be associated with lower performance. Some clue as to an explanation comes when looking at the relationships associated with the individual factors. The only significant coefficient is for recommendations, negative and of considerable size relative to the other coefficients. The negative relationship between overall selection intensity and sales appears to be driven by this factor.

As noted earlier, the literature in personnel psychology suggests that not all selection mechanisms are equally useful, and this may provide an explanation for these results. Recommendations are among the least valid and may generate information which is often useless. The fact that these establishments are spending time and effort on relatively invalid procedures may account for their poor performance as compared to other establishments. A complementary explanation for these findings is that an employer's choice of selection techniques may reveal something about their more general managerial abilities: An establishment that relies on selection practices that are

thought by experts to be largely invalid may well have similar tastes with respect to other employment practices or even management practices in related areas such as strategy formation, marketing, or accounting. In short, establishments that are bad at selection may be bad at a great many things. And the relationships reported here may therefore represent a more fundamental relationship between managerial ability and performance.

Other possible explanations might rely on reverse causation, a common issue in cross-sectional data like these. For example, one might argue that the negative relationship with selection intensity and sales might be because establishments that are doing poorly may invest more effort in selection and take it more seriously in order to improve their performance. But this explanation would have to offset arguments about resource constraints that pull in the other direction, that establishments doing poorly would have less resources (time and attention as well as money) to devote to something with a longer-term payoff like selection⁶. And even if establishments that performed poorly needed to take selection more seriously, it is not obvious why they would invest more in recommendations as opposed to relying more on applicant attitudes or education. Potential cost differences across these approaches do not seem great enough to explain the difference.

Conclusions

Examining the selection process per se, and not simply the outcomes of selection, is important for several reasons. First, the selection criteria used by employers are an important signal about what employers value in workers. They affect what kind of workers get hired and which are likely to

⁶ These results are unchanged when the analyses allow the costs of selection to vary.

have problems in the labor market -- making the transition from school-to-work, for example, or with persistent unemployment. The inequality in society that is related to employment, a long-standing concern among sociologists and economists, is therefore closely related to selection decisions.

Second, because the selection process is one of the most powerful ways to shape the characteristics of organizations, understanding differences in selection practices is a good way to begin understanding why organizations are similar or different. Schneider's (1987a) attraction-selection-attrition (ASA) model relies on selection decisions to explain how organizations become more and more homogenous. Schneider, Goldstein and Smith (1995) point out that homogeneity can have a negative effect on organizational adaptability and hence on performance.

While the literature on the effects of selection is voluminous, virtually no research has been done on the determinants of the selection process itself, on the employer's choices. Perhaps the overall conclusion from our results is that selection is a complement to a series of practices associated with giving greater importance to employees inside organizations. We find no evidence of selection serving as a substitute for other human resource practices. These results contribute to the growing literature on the relationships among employment practices - "bundles" - and the factors that drive them.

Finally, we also examined the impact of selection decisions on organizational performance, analyses that require information on differences in selection practices across organizations. The current interest in examining the effects of personnel and employment practices on organizational performance, not simply on individual outcomes (e.g., Huselid, 1996), is

relevant for selection issues as well.

We find relationships with organizational performance and selection practices that are somewhat different than those found by Terpstra and Rozell (1993). They examine relationships with performance and what we might term "best practice" selection policies, ones that have considerable support in the validation literature. Interpreting the positive relationship they find between these selection practices and firm financial performance is complicated somewhat by the fact that they are not controlling for other firm characteristics (except for industry category) which might be driving performance and correlated with human resource practices - for example, firms with higher quality management perform better in any case but also choose more sophisticated selection practices. The fact that we find negative relationships with the selection practices that are thought not to be highly valid is certainly not inconsistent with their finding, and the positive relationship we find between using education/ability measures and proficiency points in the same direction as their results.

References

- Arthur, J. (1994). Effects of human resource systems on manufacturing performance and turnover, Academy of Management Journal, 37, 670-687.
- Arvey, R. & Campion, J. (1982). The employment interview: A summary and review of recent research, Personnel Psychology, 35(2), 281-322.
- Barkley, D. (1988). The decentralization of high technology manufacturing to non-metropolitan areas, Growth and Change, 199, 12-30.
- Barron, J. & Gilley, O. (1981). Job search and vacancy contracts, American Economic Review, 71, 747-752.
- Barron, J., Bishop, J., & Dunkelberg, W. (1985). Employer Search: The Interviewing and Hiring of New Employees. Review of Economics and Statistics, 57, 43-52.
- Boudreau, J. (1991). "Utility Analysis for Decisions in Human Resource Management," in M. Dunnette and L. Hough (eds.) Handbook of Industrial and Organizational Psychology, 621-745.
- Bowles, S. & Gintis, H. (1976). Schooling in Capitalist America: Educational Reform and the Contradictions of Economic Life, New York: Basic Books.
- Bureau of National Affairs. (1988). "Recruiting and Selection Procedures." Personnel Policies Forum Survey No. 146. Washington, D.C.
- Cascio, W. (1982). Applied Psychology in Personnel Management. (2nd Edition). Reston, VA: Reston.
- Diboye, R. L. & Gaugler, B. B. (1993). "Cognitive and behavioral processes in the selection interview," in Schmitt, N., Borman, W. and Associates (eds.) Personnel Selection in Organizations, San Francisco, CA: Jossey-Bass.
- Fernandez, R. M. & Weinberg, N. (1997). Sifting and sorting: Personal

- contacts and hiring in a retail bank. Forthcoming in American Sociological Review.
- Freeman, R. & Medoff, J. (1984). What Do Unions Do? New York, NY: Basic Books.
- Galbraith, C. (1985). High technology location and development: The case of Orange County, California Management Review, 28, 99-109.
- Granovetter, M. (1974). Getting a Job: A Study of Contacts and Careers. Cambridge, MA: Harvard University Press.
- Guion, R. (1991). "Personnel Assessment, Selection and Placement," in M. Dunnette and L. Hough (eds.) Handbook of Industrial and Organizational Psychology, 327-397.
- Hartigan, J. & Wigdor, A. (1989). Fairness in Employment Testing: Validity Generalization, Minority Issues, and the General Aptitude Test Battery. Washington, D.C.: National Academy Press.
- Holzer, H. (1990). Wages, employer costs, and employee performance in the firm, Industrial and Labor Relations Review, 43, 147S-164S.
- Holzer, H. (1987). "Hiring Procedures in the Firm: Their Economic Determinants and Outcomes." in Human Resources and Firm Performance. Richard R. Block, et al. (eds.). Madison, WI: Industrial Relations Research Association.
- Holzer, H..(1996). What Employers Want: Job Prospects for Less-Educated Workers. New York: Russell Sage,
- Hunter, J. E. (1986). Cognitive ability, cognitive aptitudes, job knowledge, and job performance, Journal of Vocational Behavior, 29, 340-362.
- Hunter, J. E. & Hunter, R. F. (1984). Validity and utility of alternative predictors of job performance, Psychological Bulletin, 96(1), 72-98.

- Hunter, JE & Schmidt, FL. (1982). "Fitting people to jobs: The impact of personnel selection on national productivity," in M. Dunnette and E. Fleishman (eds.), Human Performance and Productivity: Vol. 1, Human Capability Assessment, Hillsdale, NJ: Erlbaum.
- Huselid, M. (1995). The impact of human resource management practices on turnover, productivity and corporate financial performance, Academy of Management Journal, 38, 635-672.
- Ichniowski, C., Shaw, K. & Prennushi, G. (1997). The effects of human resource management practices on productivity, Working Paper, Columbia University.
- Jackson, S.E., Schuler, R.S. & Rivero, J.C.. (1989). Organizational Characteristics as Predictors of Personnel Practices. Personnel Psychology, 42, 727-786.
- Jacoby, S. (1985). Employing Bureaucracy: Managers, Unions, and the Transformation of Work in American Industry, 1900-1945. New York: Columbia University Press.
- Jones, G. R. (1984). Task visibility, free riding, and shirking: Explaining the effect of structure and technology on employee behavior, Academy of Management Review, 9, 684-695.
- Klimoski, R. & Jones, R. (1995). "Staffing for effective group decision making: Key issues in matching people and teams" in Guzzo, R., Salas, E. and Associates (eds.) Team Effectiveness and Decision Making in Organizations. San Francisco, CA: Jossey-Bass.
- Krueger, A. B. (1993). How computers have changed the wage structure: Evidence from Microdata, 1984-1989, Quarterly Journal of Economics, 108, 33-60.

- Levy, F. and Murnane, R. J. (1996). With what skills are computers a complement? American Economic Review, 86, 258-262.
- MacDuffie, J. P. (1995). Human resource bundles and manufacturing performance: Organizational logic and flexible production systems in the world auto industry, Industrial and Labor Relations Review, 48, 197-221.
- McCall, B. P. (1990). Occupational matching: A test of sorts, Journal of Political Economy, 98(1), 45-69.
- McCall, J. J. (1970). Economics of information and job search, Quarterly Journal of Economics, 84(1), 113-126.
- McDaniel, M., Whetzel, D., Schmidt, F., & Maurer, S. (1994). The validity of employment interviews: A comprehensive review and meta-analysis, Journal of Applied Psychology, 79, 599-616.
- Miles, R. E. & Snow, C. C. (1984). Designing strategic human resources systems. Organizational Dynamics, 13, 36-52.
- Milgrom, P. & Roberts, J. (1992). Economics, Organization & Management. Englewood Cliffs, NJ: Prentice-Hall.
- O'Reilly, C. A., III. (1977). Personality-job fit: Implications for individual attitudes and performance, Organizational Behavior and Human Performance, 18, 36-46.
- Rynes, S. (1991). Recruitment, job choice, and post-hire consequences: A call for new research directions, in M. Dunnette and L. Hough (eds.) Handbook of I/O Psychology, 399-444.
- Schneider, B. (1987a). The people make the place, Personnel Psychology, 40, 437-453.

- Schneider, B. (1987b). $E=f(P,B)$: The road to a radical approach to person-environment fit, Journal of Vocational Behavior, 31, 353-361.
- Schneider, B., Goldstein, H. & Smith, D.B. (1995). The ASA framework: An update, Personnel Psychology, 48, 747-773.
- Schneider, B. & Schmitt, N. (1986). Staffing Organizations. Glenview, IL: Scott, Foresman.
- Schuler, R.S. & S.E. Jackson. (1987). Organizational Strategy and Organizational Level as Determinants of Human Resource Management Practices. Human Resource Planning, 10, 125-141.
- Schwab, D., Rynes, S.L., & Aldag, R.J.. (1987). "Theories and Research on Job Search and Choice." In Research in Personnel and Human Resource Management, Vol. 5, 129-166.
- Stevens, M. J. and Campion, M. A. (1994). The knowledge, skill, and ability requirements for teamwork: Implications for Human Resource Management, Journal of Management, 20, 503-530.
- Terpstra, D. & E. Rozell. (1993). The Relationship of Staffing Practices to Organizational Level Measures of Performance, Personnel Psychology, 46, 27-47.
- Wanous, J. P. (1977). Organizational entry: Newcomers moving from outside to inside, Psychological Bulletin, 84(4), 601-618.
- Wanous, J. P. (1976). Organizational entry: From naive expectations to realistic beliefs, Journal of Applied Psychology, 61, 22-29.
- Wilk, S., L. B. Desmarais and P. Sackett (1995). Gravitation to jobs commensurate with ability: Longitudinal and cross-sectional tests, Journal of Applied Psychology, 80(1), pp. 79-85.

Appendix

Table 3
Means, Standard Deviations and Intercorrelations between Key Study Variables

Variable	1	2	3	4	5	6	7	8	9
Dependent Var.									
1. Selection Intensity	--								
2. Ability/Education	78**	--							
3. Attitude/Experience	60**	21**	--						
4. Recommendations	61**	25**	14**	--					
5. Log(Sales)	08**	18**	01	-12**	--				
6. % Proficient	06**	05*	06**	02	00	--			
Independent Var.									
7. Skill Require. Increased	14**	20**	08**	-05**	16**	-03	--		
8. TQM	13**	19**	05**	-01	25**	01	20**	--	
9. % Computer Use	22**	23**	23**	-01	18**	03	18**	07**	--
10. % Meetings	13**	13**	11**	02	07**	00	18**	17**	17**
11. Hours Per Wrkr Trained	12**	11**	07**	05**	-07*	00	06*	04	04
12. Log(Salary)	16**	23**	08**	-08**	29**	13**	18**	14**	21**
13. % Unionized	-04*	06**	-10**	-08**	21**	04*	04*	12**	-09**
14. % Women	10**	05*	12**	07**	-02	-03	02	-03	19**
15. % Minorities	-11**	-13**	-08**	00	-06	-07**	-05**	01	-16**
16. Avg Yrs of Edu	11**	10**	11**	01	02	-01	06**	-03	21**
17. Compete by Innovation	01	02	02	-03	07**	-02	-01	01	04*
18. %Tenure < 1 Yr	-12**	-17**	-05*	01	-16**	-25**	-05*	-11**	-06**
Mean (Std. Dev.)	35.43 (6.62)	0.00 (0.82)	0.00 (0.71)	0.00 (0.67)	10.26 (2.17)	82.12 (16.21)	0.66 (0.47)	0.53 (0.50)	41.85 (36.95)

Table 3 (Contd.)

Means, Standard Deviations and Intercorrelations between Key Study Variables

Variable	13	14	15	16	17	18
13. % Unionized	--					
14. % Women	-.27**	--				
15. % Minorities	.01	.08**	--			
16. Avg Yrs of Edu	-.05**	.01	-.10**	--		
17. Compete by Innovation	-.07**	.03	-.02	-.01	--	
18. %Tenure < 1 Yr	-.20**	.20**	.15**	-.02	-.04	--
Mean	21.01	40.53	26.58	12.07	0.05	15.05
(Std. Dev.)	(33.69)	(26.47)	(25.59)	(1.59)	(0.21)	(17.03)

Note. Decimals have been omitted.

* p < .05. ** p < .01.

Table 1: Description of Key Study Variables

Log(Total Sales)	Organizations total sales for the past calendar year (dollars)
% Proficient	Percentage of total workforce who are believed to be fully proficient at their current job
Selection Process	Respondents were asked to indicate which of the following they believe are important to consider when they hire a front-line, production level worker: previous work experience, years of completed schooling, attitude, communication skills, test scores (if applicable), etc. (See Table 2 for a more detailed description of this 11-part question.)
Selection Costs	The percentage of total labor costs spent annually on recruiting and selection of employees for this establishment (in dollars).
Compete by Innovation	Whether or not organization believes innovation is the most important way it competes in its product or service market
Multi-Establishment	Whether the establishment is one of several (coded 1) or a single establishment (coded 0).
Year Began Operation	The year the establishment began operations. If before 1900, 1900 was entered.
Employment Up/Down	Change in employment over the last 3 years (percentage)
% Tenure < 1 Year	Percentage of the current workforce that have been with the organization for less than 1 year (tenure proxy)
Industry	20 industry dummy variables were used to control for industry effects
Size	5 categories were used to denote the size of the firm: 20-49, 50-99, 100-249, 250-1000 and > 1000 (omitted category)
% Women	Percentage of total workforce that are women.
% Minorities	Percentage of total workforce that are minorities (include categories such as African American, Hispanic, Asian, Pacific Islander and Native American)
Average Years of Education for Production Workers	Average years of completed schooling for production workers
% Unionized	Percentage of workforce covered by a collective bargaining agreement.
Log(Production Workers Salary)	Average pay for production workers
Skill Requirements Increased	Over the last 3 years, increase (or decrease) of skills required to perform production or support jobs at an acceptable level

TQM	Adoption of a formal Total Quality Management program
% Computer Use	Percentage of the production workers who use computers in their jobs
% Participate in Meetings	Percentage of non-managerial and non-supervisory employees who are involved in regularly scheduled meetings to discuss work-related problems
Log(Hours Production Workers Trained)	Average number of hours of training in the past year per production worker

Table 2: Means and Standard Deviations for Selection Question

When you consider hiring a new production (front-line) worker, how important are the following in your decision to hire? (5 = very important, 1 = not important or not considered)

<u>ITEM</u>	<u>M</u>	<u>STD</u>
Previous work experience of the applicant	4.10	1.03
Previous employer's recommendation	3.25	1.22
Years of completed schooling	3.15	1.16
Academic performance (grades)	2.59	1.12
Teacher recommendations	2.00	1.12
Recommendations from current employees	3.16	1.13
Experience or reputation of applicant's school	2.47	1.17
Applicant's attitude	4.52	0.74
Applicant's communication skills	4.12	0.93
Score received in any tests administered as part of the interview	2.82	1.55
Industry-based credentials (certifying applicant's skills)	3.10	1.30

Table 4: Determinants of Selection Intensity
(Standard Errors in Parentheses)

Variable Name	Selection Intensity		
	(1)	(2 ^a)	Hypothesis Tested
Compete by Innovation	-0.24 (0.79)	-0.62 (0.97)	H1
Avg. Years of Edu. (Production)	0.53** (0.17)	0.60** (0.21)	H1
Skill Requirements Increased	0.54 (0.36)	0.84* (0.44)	H1
TQM	1.09** (0.37)	0.45 (0.43)	H1
% Use Computers	0.02** (0.01)	0.02** (0.01)	H1
% Participate in Meetings	0.01 (0.00)	0.01 (0.00)	H1
% Wrkrs < 1 Year Tenure	-0.03** (0.01)	-0.03* (0.01)	H2
% Unionized	-0.01 (0.01)	-0.01 (0.01)	H3
Size 20-49	-0.63 (0.80)	-0.29 (0.97)	H4
Size 50-99	-0.50 (0.73)	-0.45 (0.86)	H4
Size 100-249	-0.27 (0.66)	-0.83 (0.78)	H4
Size 250-1000	0.14 (0.58)	0.12 (0.63)	H4
Log(Hrs. per Prod Wrkrs Trnd)		0.42** (0.16)	H5A,B
Log (Production Wrks Salary)	1.70** (0.55)	1.72** (0.66)	H6A,B
Year Began Operation	-0.01* (0.00)	-0.02* (0.00)	H7

% Women	0.02*	0.04**
	(0.01)	(0.01)
% Minority	-0.02**	-0.01
	(0.01)	(0.01)
adj. R ²	0.12	0.11
Overall F	5.75**	3.75**

Note: Controls not shown include Log(Total Sales), Multi-establishment, Employment Up, Employment Down and Industry variables.

**p < .01 *p < .05

^a Includes training and also controls for selection costs.

Table 5: Multivariate-Tests for Differences between Selection Equations

	Comparison Between:		
	Ability/Education and Recommendations	Ability/Education and Attitude/Experience	Attitude/Experience and Recommendations
Overall Equation	***	***	***
% Unionized	*	**	0
Hrs per Prod Wrkr Trained	0	0	0
% Minority	*	*	0
% Women	0	0	0
Skills Increased	***	0	**
TQM	*	0	0
% Computer Use	***	0	**
% Participate in Meetings	0	0	0
Prod. Salary	*	**	0

Note: Results from Wilks' Lamda reported.

*** $p < .001$, ** $p < .01$, * $p < .05$, 0 = fail to reject the null hypothesis that the coefficients were the same.

Table 6: Regression Results for Outcomes of Selection Practices, % Proficient
(Standard Errors in Parentheses)

Variables	% Proficient			
	Manuf	Non-Manuf	Manuf	Non-Manuf
Constant	81.88** (15.66)	111.19** (16.19)	78.83** (15.72)	108.04** (16.13)
Establishment Characteristics				
Log (Capital/Labor)	-0.57 (0.54)	0.12 (0.49)	-0.59 (0.55)	0.08 (0.49)
Multiple Establishments	1.86 (1.55)	-2.32 (1.94)	1.95 (1.57)	-2.35 (1.95)
Employment Up	1.06 (1.65)	-0.05 (2.18)	0.90 (1.66)	0.45 (2.20)
Employment Down	-1.49 (1.88)	-3.10 (2.43)	-1.52 (1.90)	-3.87 (2.42)
Industry Controls	Yes	Yes	Yes	Yes
Size Controls	Yes	Yes	Yes	Yes
Worker Characteristics				
Average Education	-0.67 (0.71)	-0.57 (0.72)	-0.59 (0.72)	-0.69 (0.72)
% Workers < 1 Year	-0.36** (0.06)	-0.16** (0.05)	-0.36** (0.06)	-0.17** (0.05)
% Minorities	-0.08** (0.03)	0.01 (0.04)	-0.08** (0.03)	0.02 (0.04)
% Women	-0.01 (0.04)	0.05 (0.05)	-0.01 (0.04)	0.06 (0.05)
% Production Workers	0.09 (0.09)	-0.19* (0.09)	0.11 (0.09)	-0.19* (0.09)
% Supervisory Workers	0.28 (0.16)	-0.23 (0.15)	0.28 (0.16)	-0.22 (0.15)
% Technical Workers	0.13 (0.12)	-0.31** (0.10)	0.15 (0.12)	-0.33** (0.10)
% Clerical/Sales Workers	0.21 (0.12)	-0.21 (0.11)	0.22 (0.13)	-0.22 (0.11)
Unionized	-2.89 (1.53)	2.51 (2.47)	-2.73 (1.57)	2.74 (2.49)
Selection Practices				
Selection Costs	-0.14 (0.12)	0.12 (0.12)	-0.14 (0.12)	0.13 (0.12)
Selection Intensity	-0.01 (0.11)	-0.10 (0.14)	--	--
Education/Ability	--	--	-0.83 (0.94)	2.51* (1.30)
Attitudes/Experience	--	--	0.70 (1.00)	-0.80 (1.26)

Recommendations	--	--	0.12 (1.06)	-4.23** (1.52)
Sample Size	575	345	570	341
R ²	0.12	0.14	0.13	0.16
Overall F	2.77**	1.76**	2.62**	1.89**

Note: **p < .01 *p < .05

Table 7: Regression Results for Outcomes of Selection, Log(Sales)
(Standard Errors in Parentheses)

Variables	Log(Sales)			
	Manuf	Non- Manuf	Manuf	Non- Manuf
Constant	5.73 (2.33)	2.05 (2.66)	5.51 (2.38)	1.82 (2.70)
Multiple Establishment	0.13 (0.11)	0.03 (0.18)	0.14 (0.11)	0.02 (0.18)
Log Capital	0.36** (0.05)	0.28** (0.06)	0.36** (0.05)	0.28** (0.06)
Log Materials	0.04 (0.04)	0.03 (0.06)	0.04 (0.04)	0.04 (0.06)
Log Hours	0.54 (0.44)	1.41** (0.55)	0.53 (0.44)	1.36* (0.56)
% Equipment < 1 Year	0.00 (0.01)	0.01* (0.00)	0.00 (0.01)	0.01* (0.00)
% Equipment 1-4 Years Old	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Above Capacity	0.08 (0.18)	-0.04 (0.32)	0.06 (0.19)	-0.04 (0.32)
Below Capacity	-0.03 (0.11)	-0.05 (0.17)	-0.01 (0.11)	-0.03 (0.17)
Export	0.00 (0.00)	0.01 (0.00)	0.00 (0.00)	0.01 (0.01)
R&D Center	0.07 (0.11)	0.05 (0.20)	0.08 (0.12)	0.06 (0.20)
Year Began Operations	0.00 (0.00)	0.01 (0.00)	0.00 (0.00)	0.01 (0.00)
Compete by Price	0.03 (0.12)	0.31 (0.22)	0.04 (0.12)	0.31 (0.22)
Compete by Quality	-0.09 (0.11)	0.31 (0.21)	-0.07 (0.12)	0.34 (0.22)
Industry Controls	Yes	Yes	Yes	Yes
Size Controls	Yes	Yes	Yes	Yes
Log Avg. Education	0.38 (0.62)	-0.09 (0.70)	0.29 (0.63)	-0.05 (0.71)
Log Trained	-0.02 (0.05)	0.16* (0.08)	-0.03 (0.05)	0.16* (0.08)
% Workers < 1 Year	0.00 (0.00)	-0.01** (0.00)	0.00 (0.00)	-0.01** (0.00)
Unionized	0.04 (0.12)	0.48* (0.22)	0.01 (0.12)	0.51* (0.22)
Selection Cost	0.00 (0.01)	-0.02* (0.01)	0.00 (0.01)	-0.02* (0.01)
Selection Intensity	-0.02* (0.01)	-0.01 (0.01)	--	--
Education/Ability	--	--	-0.05 (0.07)	-0.09 (0.12)

Attitude/Experience	--	--	-0.02 (0.07)	0.03 (0.81)
Recommendations	--	--	-0.17* (0.08)	-0.03 (0.14)
Sample Size	572	359	567	354
R ²	0.62	0.53	0.63	0.53
Overall F	27.96**	11.25**	26.15**	10.42**

Note: **p < .01 *p < .05

Table A1: Principle Factor Analysis of Selection Types, with Varimax Rotation

Variables	Ability/Educ	Recommendations	Attitude/Exper
Academic performance (grades)	0.78	0.24	0.07
Years of completed schooling	0.73	0.04	0.18
Experience or reputation of applicant's school	0.57	0.40	-0.02
Score received in any tests administered as part of the interview	0.52	-0.11	0.11
Industry-based credentials (certifying applicant's skills)	0.50	0.03	0.24
Recommendations from current employees	-0.15	0.77	0.16
Teacher recommendations	0.46	0.65	-0.14
Previous employer's recommendation	0.06	0.54	0.32
Applicant's attitude	0.05	0.18	0.75
Applicant's communication skills	0.38	0.02	0.68
Previous work experience of the applicant	0.11	0.06	0.58
Variance Explained	2.39	1.65	1.63

Note: Bolded factor loadings indicate the items that were used for each scale.

Table A2: Additional Analyses for Determinants of Selection Intensity
(Standard Errors in Parentheses)

Variable Name	Selection Intensity	
	(1)	(2)
Recruiting Costs	0.12** (0.03)	0.14** (0.03)
Proficiency	0.01 (0.01)	
% Labor/Production Costs		0.01 (0.01)
Log(Capital/Production Labor Costs)		-0.15 (0.13)
Log(Average Hrs. Supervisor Trains)		0.28* (0.13)
Year Began Operation	-0.01 (0.01)	-0.01 (0.01)
% Wrkrs < 1 Year Tenure	-0.04** (0.01)	-0.04** (0.01)
% Unionized	-0.01 (0.01)	-0.01 (0.01)
Size 20-49	-0.23 (0.84)	0.21 (0.99)
Size 50-99	-0.32 (0.77)	0.35 (0.91)
Size 100-249	-0.27 (0.70)	0.18 (0.83)
Size 250-1000	-0.08 (0.59)	0.41 (0.71)
% Women	0.02* (0.01)	0.02* (0.01)
% Minority	-0.02* (0.01)	-0.02* (0.01)
Compete by Innovation	-0.24 (0.79)	-0.62 (0.97)
Avg. Years of Edu. (Production)	0.46** (0.18)	0.54** (0.21)
Skill Requirements Increased	0.74* (0.38)	0.70 (0.44)

TQM	0.87* (0.39)	0.62 (0.45)
% Use Computers	0.02** (0.01)	0.03** (0.01)
% Participate in Meetings	0.00 (0.00)	0.01 (0.00)
Log (Production Wrks Salary)	2.00** (0.57)	1.82** (0.65)
adj. R ²	0.12	0.13
Overall F	5.22**	4.46**

Note: Controls not shown include Log(Total Sales), Multi-establishment, Employment Up, Employment Down and Industry variables. **p < .01 *p < .05

Table A3: Determinants of Selection on Education and Ability
(Standard Errors in Parentheses)

Variable Name	Selection on Education and Ability		
	(1)	(2 ^a)	Hypothesis Tested
Compete by Innovation	-0.06 (0.09)	-0.05 (0.12)	H1
Avg. Years of Edu. (Production)	0.08** (0.02)	0.07** (0.03)	H1
Skill Requirements Increased	0.12** (0.04)	0.13** (0.05)	H1
TQM	0.12** (0.04)	0.01 (0.05)	H1
% Use Computers	0.003** (0.00)	0.003** (0.00)	H1
% Participate in Meetings	0.00 (0.00)	0.00 (0.00)	H1
% Wrkrs < 1 Year Tenure	-0.003** (0.00)	-0.004** (0.00)	H2
% Unionized	0.00 (0.00)	0.00 (0.00)	H3
Size 20-49	-0.25** (0.10)	-0.25* (0.12)	H4
Size 50-99	-0.16 (0.09)	-0.14 (0.10)	H4
Size 100-249	-0.08 (0.08)	-0.12 (0.09)	H4
Size 250-1000	-0.00 (0.07)	0.01 (0.08)	H4
Log(Hrs. per Prod Wrkrs Trnd)		0.05** (0.02)	H5A,B
Log (Production Wrks Salary)	0.24** (0.07)	0.28** (0.08)	H6A,B
Year Began Operation	-0.002** (0.00)	-0.002** (0.00)	H7

% Women	0.002*	0.004**
	(0.00)	(0.00)

% Minority	-0.002**	-0.00
	(0.00)	(0.00)

adj. R ²	0.18	0.17
Overall F	8.93**	5.76**

Note: Controls not shown include Log(Total Sales), Multi-establishment, Employment Up, Employment Down and Industry variables.

**p < .01 *p < .05

^a Includes training and also controls for selection costs.

Table A4: Determinants of Selection on Attitudes and Experience
(Standard Errors in Parentheses)

Variable Name	Selection on Attitudes and Experience		
	(1)	(2 ^a)	Hypothesis Tested
Compete by Innovation	0.08 (0.09)	0.07 (0.11)	H1
Avg. Years of Edu. (Production)	0.04* (0.02)	0.07** (0.02)	H1
Skill Requirements Increased	0.06 (0.04)	0.10* (0.05)	H1
TQM	0.08* (0.04)	0.03 (0.05)	H1
% Use Computers	0.002** (0.00)	0.002* (0.00)	H1
% Participate in Meetings	0.00 (0.00)	0.00 (0.00)	H1
% Wrkrs < 1 Year Tenure	-0.003* (0.00)	-0.00 (0.00)	H2
% Unionized	-0.001* (0.00)	-0.00 (0.00)	H3
Size 20-49	0.17 (0.09)	0.15 (0.11)	H4
Size 50-99	0.09 (0.08)	0.10 (0.09)	H4
Size 100-249	0.03 (0.07)	-0.01 (0.09)	H4
Size 250-1000	0.05 (0.06)	0.09 (0.07)	H4
Log(Hrs. per Prod Wrkrs Trnd)		0.03 (0.02)	H5A,B
Log (Production Wrks Salary)	0.04 (0.06)	0.01 (0.07)	H6A,B
Year Began Operation	0.00 (0.00)	0.00 (0.00)	H7

% Women	0.00	0.00
	(0.00)	(0.00)

% Minority	0.00	-0.00
	(0.00)	(0.00)

adj. R ²	0.08	0.08
Overall F	4.37**	2.97**

Note: Controls not shown include Log(Total Sales), Multi-establishment, Employment Up, Employment Down and Industry variables.

**p < .01 *p < .05

^a Includes training and also controls for selection costs.

Table A5: Determinants of Selection using Recommendations
(Standard Errors in Parentheses)

Variable Name	Selection on Recommendations		
	(1)	(2 ^a)	Hypothesis Tested
Compete by Innovation	-0.07 (0.08)	-0.16 (0.10)	H1
Avg. Years of Edu. (Production)	0.00 (0.02)	0.01 (0.02)	H1
Skill Requirements Increased	-0.07 (0.04)	-0.05 (0.05)	H1
TQM	0.03 (0.04)	0.06 (0.05)	H1
% Use Computers	0.00 (0.00)	0.00 (0.00)	H1
% Participate in Meetings	0.00 (0.00)	0.00 (0.00)	H1
% Wrkrs < 1 Year Tenure	-0.00 (0.00)	-0.00 (0.00)	H2
% Unionized	-0.001* (0.00)	-0.001* (0.00)	H3
Size 20-49	0.11 (0.08)	0.19 (0.10)	H4
Size 50-99	0.07 (0.08)	0.08 (0.09)	H4
Size 100-249	0.05 (0.07)	0.02 (0.08)	H4
Size 250-1000	0.05 (0.06)	-0.00 (0.07)	H4
Log(Hrs. per Prod Wrkrs Trnd)		0.03 (0.02)	H5A,B
Log (Production Wrks Salary)	0.07 (0.06)	0.09 (0.07)	H6A,B
Year Began Operation	-0.00	-0.00	H7

	(0.00)	(0.00)
% Women	0.00 (0.00)	0.003** (0.00)
% Minority	-0.00 (0.00)	-0.00 (0.00)
adj. R ²	0.02	0.03
Overall F	1.82**	1.77**

Note: Controls not shown include Log(Total Sales), Multi-establishment, Employment Up, Employment Down and Industry variables.

**p < .01 *p < .05

^a Includes training and also controls for selection costs.